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Document information

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1	25.11.2022	Daniela Stozno, Rob Clarke, Chris Baird, Jens Biegert	

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Introduction

WP6 “High-power lasers: Technology development for future multi-PW laser facilities” has the following objectives

- Develop new optics and metrology technologies as key technological foundations for future multiPW (peta watt) laser facilities
- Use relativistic plasma mirrors as light condensers to approach the Schwinger limit
- Design a spatio-temporal diagnostics device for ultrashort & ultraintense laser pulses at multi-PW laser facilities with low repetition rates
- Train researchers and engineers in intense laser science, metrology and applications

Task 6.3 deals with “Training and scientific exchange”, under joint responsibility of Laserlab-Europe AISBL and ELI-ERIC. In particular, Laserlab-Europe provides a platform for dedicated knowledge sharing and training on the topics of intense laser pulse propagation, pulse contrast enhancement, and pulse metrology. This is realized through a series of events in which these relevant topics are discussed among the partners in conjunction with leading experts from Laserlab-Europe and external internationally renowned instructors. The regularity of these training events provides a sustainable laser science forum in which knowledge and state-of-the-art results are shared and best practices are developed.

The training events had been conceived as on-site trainings with hands-on sessions in partner labs, and the Covid-19-related restrictions on travels and meetings in presence made it necessary to postpone the planned trainings, in particular the CLF training weeks. After adapting the initial plans and organising an online training event on “Modelling of ultra-intense laser propagation in plasmas and laser-plasma accelerators” in 2021, finally a training event on site became possible in summer 2022.

CLF training weeks on experimental laser-plasma physics

The Central Laser Facility, based at the UK’s Rutherford Appleton Laboratory provides a training platform for new PhD students to learn the key skills to participate in high power laser experiments. The event provides an opportunity to network with other students from across Europe whilst taking part in the training. The course covers the basic skills required for experimental laser-plasma physics - everything from optical alignment and target manufacturing through to setting up an experimental geometry, taking shots and analysing data.

With life getting back more to normal, the Central Laser Facility (CLF) once again hosted its training weeks program for new PhD students in summer 2022. Following the Covid pandemic the course saw a few changes in delivery but maintained the overall aim to train up inexperienced PhD students in the practical elements of fielding laser-plasma experiments. Twelve individual courses were held, each containing up to four students, with the last 2 courses, taking place from 25 July to 5 August and 1 to 12 August 2022, dedicated to attendees from the EURIZON project.

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Each two-week course was broken into two distinct weeks. Week 1 was dedicated towards the basic elements of experiments, covering a wide range of topics including:

- Basic optics and optomechanics
- Imaging systems
- Parabola alignment
- Spectrometers
- Particle diagnostics, e.g. Thomson Spectrometer, electron spectrometer, radiochromic film (RCF) pack design
- Optics handling
- Target fabrication

This first week, which was primarily practical, ensured each student was provided with the knowledge required for the second week – bringing these skills into the laboratory for a mini-experiment. This took place in Vulcan's Target Area West (TAW) facility. This experimental week challenged the students to build an experiment from scratch, with only the primary beamline optics in place. The students checked the main beam alignment, built imaging lines to reference target position, optimised the focus and installed diagnostics including:

- Focal spot imaging camera
- Dual target reference imaging lines
- Active x-ray pinhole camera
- Passive x-ray pinhole camera
- Optical spectrometer
- Radiochromic film pack.

The groups were challenged in the experimental design and strategy, highlighting common issues and ways to avoid them. The CLF tutors guided the students through the best approach in building the experiment to avoid conflicts of diagnostics and tackling the everyday problems of space constraints, as well as organising themselves to optimise their work and record their work with good lab processes.

The second week finished with shots to target on thin foils to generate proton beams and basic analyses of their results. The group also had the opportunity to observe the impacts of electromagnetic pulses (EMP) on active diagnostics. The practical skills developed through the course were backed with development of "soft skills", encouraging good communication, teamwork and leadership, with regular catch-up sessions – key skills which form the basis for a successful experimental campaign.

The second group started a week later than the first group and copied the program. By offsetting the start dates the groups had a week overlap to network and learn about what everyone is doing.

The participants in this year's training courses came from the UK, Romania, France, Sweden, Poland and Germany. The majority were 1st year and 2nd year PhD students, but also a number of industrial / non-academic attendees participated.

The CLF was proud to once again provide this course for the plasma physics community.

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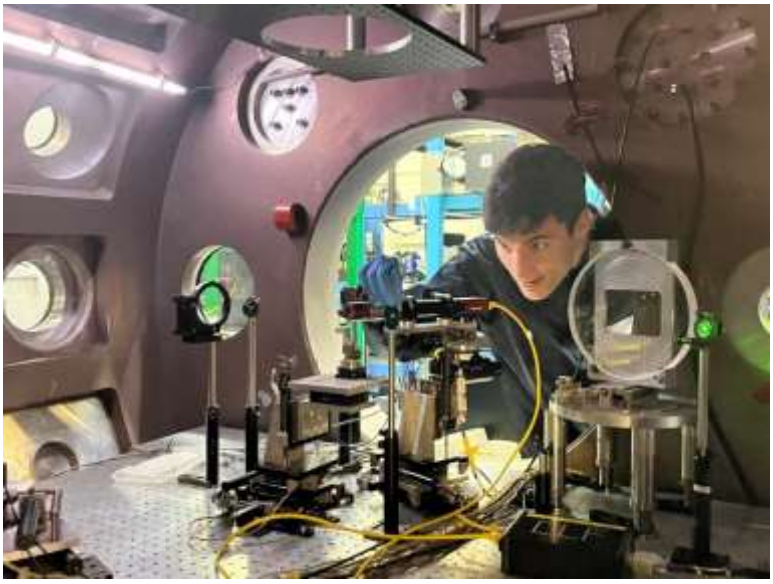
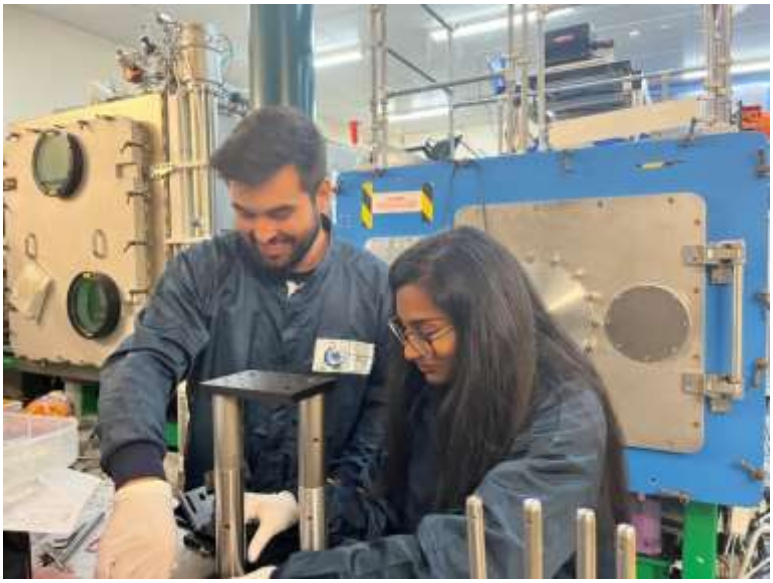
Impressions

Below are a selection of images from the course





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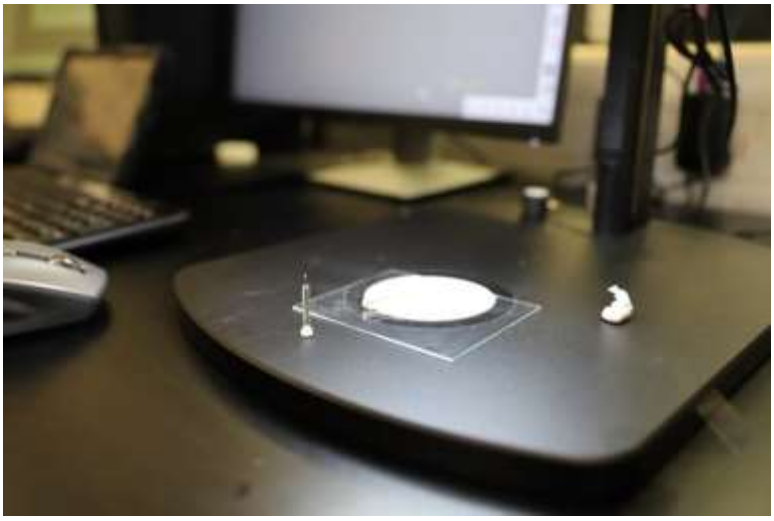

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